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AN ENGINEERING EDUCATION

MINING ENGINEERING
MECHANICAL ENGINEERING
CIVIL ENGINEERING

UNIVERSITY OF NEVADA
RENO

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THE COLLEGE OF ENGINEERING

UNIVERSITY OF NEVADA

RENO

THE MACKAY SCHOOL OF MINES

FOREWORD

The successful man of tomorrow is the one who has a good education, a thorough training for a special field of activity. The technical school is responsible to a large degree for the advancement that has thus far been made in the science of Engineering, yet much remains to be done. The industries and commerce of the world are for the most part directed by men of broad, yet thorough training. Nevada has recognized the fact that, in order to equip her sons for positions of responsibility and usefulness, she must provide for them an efficient school in Mining and Mechanical and Civil Engineering. Nevada graduates have made a good record in this and in foreign countries. There is a demand for them which cannot yet be supplied. No state in the Union makes more liberal concessions to her young men, who wish to gain an engineering education, than does the State of Nevada. All expenses are reduced to a minimum.

This illustrated pamphlet is sent to the young men of Nevada and other states with the thought that it will give an outline of the great advantages which are offered by the engineering college of the University of Nevada. The three schools of engineering—the School of Mines, the School of Mechanical Engineering, and the School of Civil Engineering—comprise the Engineering College.

Mr. Clarence H. Mackay and his mother, Mrs. John W. Mackay, have given a fine building to the School of Mines. This building will house the departments of Mining and Geology, and will also contain a museum of interesting mineral specimens, representing every phase of the mineral wealth of Nevada, California and Utah.

To bring the student into close connection with actual conditions and with the men engaged in actual engineering practice, a club of all the engineering students has been maintained. Prominent engineers, technical and business men, are invited from time to time to address this club and present either their experiences or describe some piece of engineering work in which they may have been especially interested. The enthusiasm and interest of the student is kindled by many of these addresses.

THE MACKAY SCHOOL OF MINES

This department of the University was established by an Act of the Legislature in 1882. No very substantial aid was forthcoming from the State until after the discovery of Tonopah and the consequent revival of the mining industry of the State. From a gold and silver production of $2,820,290 in 1900, Nevada in 1905 reached $9,184,996 and will undoubtedly considerably exceed this in 1906. The steady development of the old districts and the discovery of new ones insure for some time to come that Nevada will maintain its position as a precious metal producing state. With Ely rapidly coming to the producing stage, the State also seems destined to take a leading position as a copper producer. Consequent on the general prosperity attending these discoveries, the finances of the State improved to such an extent that the University secured from the Legislature of 1905 the first substantial appropriation for the equipment of the Mining Department. The gift of a complete new mining building to the University in 1906 by Mr. Clarence H. Mackay, insures the proper housing of the department. The Legislature of 1907 has given all the necessary financial support for the equipment and maintenance of this building. A reasonable financial support from both State and private beneficence is assured for the future.

The course of instruction is laid out to give the student a thorough grounding in the essential fundamentals, and to give such acquaintance with the practical side of the work as is possible in the time alloted to the course. Two years of the four-year course are given to the study of English, mathematics, chemistry, physics, drafting and mineralogy. The remaining two years are devoted to the purely technical subjects together with higher mathematics and mechanics.

The mining and metallurgical instruction is divided between class room, laboratory and field. The class room work comprises about an equal division between lectures and recitations. Laboratory work in conjunction with the mining lectures comprises problems in design of surface and underground mine equipment, mapping, graphical representation of underground and geological data; in metallurgy, the study of ore-treatment plants from drawings, designs and graphical representations of metallurgical processes. In the metallurgical laboratory

VIEW OF CAMPUS

the examination of ores, testing by small scale tests, woring tests and experimental study of principles are carried out. The field work includes the study of a mining district from the standpoints of mining and metallurgical practice, underground and surface geology. In the past Virginia City, Tonopah and Goldfield have been visited by different classes and in the future, not only will these districts be revisited, but Ely and other new camps will be included. To give the student self-reliance and to remove some of the rawness and greenness of many of the young students, classes in wood and machine shops, blacksmith work, forging, tool making, use of hand and machine drills are conducted.

BUILDING AND LABORATORIES

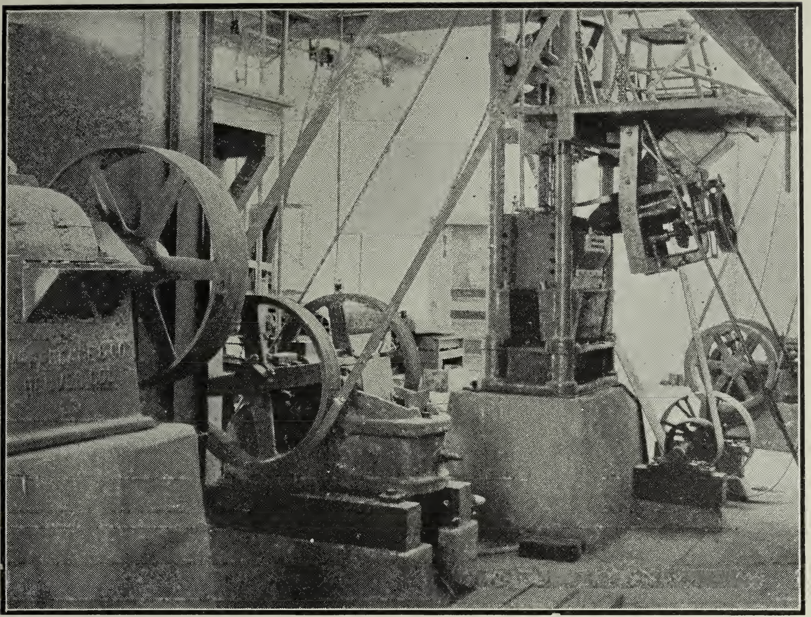
All these departments of Mining, Metallurgy and Geology are closely coordinated, are in one building, and are directed by the mining faculty as a unit.

The building is U shaped, the main building being two stories and occupying the front with two single story wings in the rear. A court and library occupy the space between the wings. The first floor contains Geological Lecture room, office and laboratory, chemical laboratory, weighing rooms, library and drafting-room, geological museum, assaying laboratory and metallurgical and mining laboratory; the second floor—mineralogical and research laboratories, mining lecture room and offices.

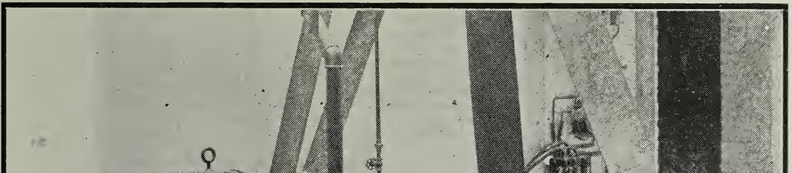
THE EQUIPMENT OF THE LABORATORIES

The Chemical Laboratory is divided into two parts—the working laboratory proper, which is equipped with the usual desks, sinks, hoods, hot-plates and air baths, and the weighing room, which is equipped with two analytical balances, pulp balances, and chemical lockers.

The Assaying Laboratory comprises the following rooms—furnace and pulp room, parting, weighing, and store rooms. The furnace room is equipped with 3 double-muffle furnaces, burning soft coal, 4



MINING LABORATORY



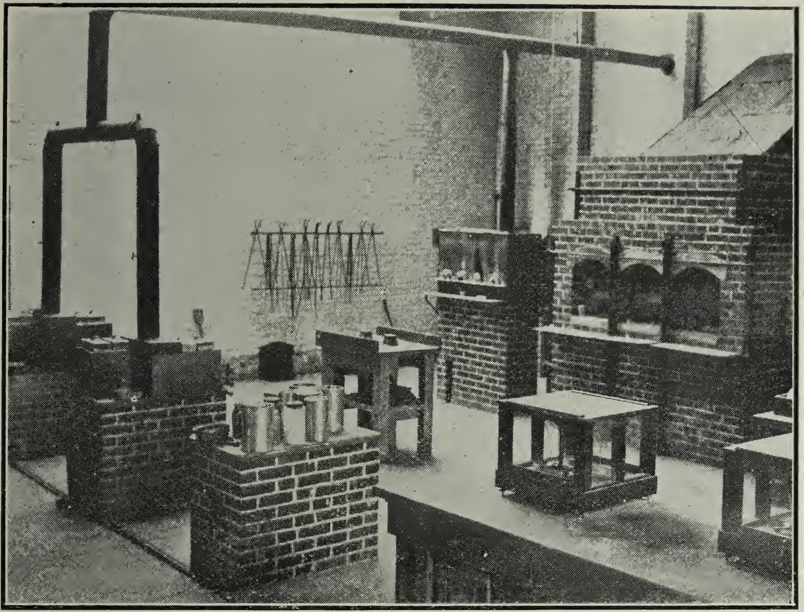
MINING LABORATORY

oil-fired crucible furnaces, 4 oil-fired muffle, 1 coke-melting and 2 coke-muffle furnaces. The parting room is equipped with gas-heated hot-plates, cement tables, hood, and bullion rolls. The weighing room contains 4 Becker bead balances, an Ainsworth, an Oertling, and a Keller balance. The store room is amply provided with shelving and drawers for assaying and chemical supplies.

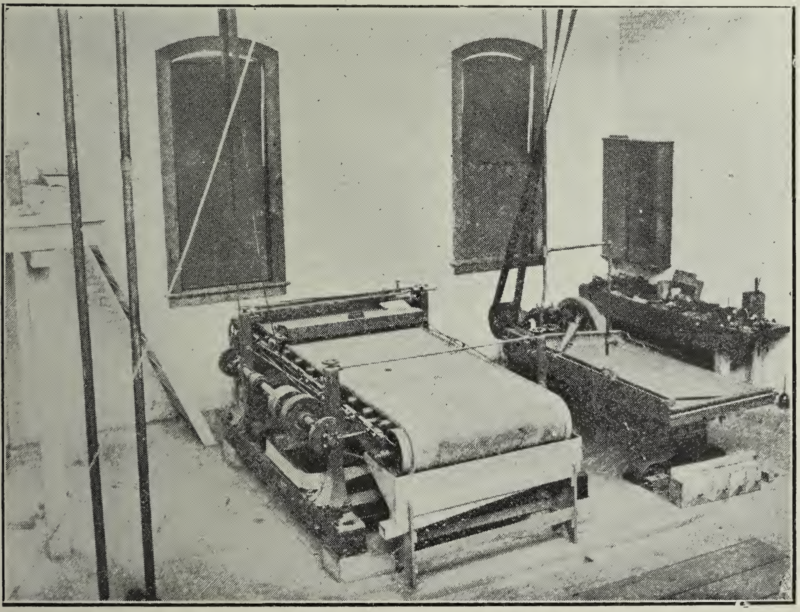
The METALLURGICAL AND MINING LABORATORY—The metallurgical equipment includes the following machinery, all of commercial size: A 3-stamp battery and feeder, amalgamation plates on steel table, a 4-foot Union concentrator, a Wilfley concentrating table, a 2-compartment jig, classifiers, and sizing cones, a 4 x 8 rock-breaker of the Sturtevant type, 10 x 14 crushing rolls, a 2 x 6 Columbian separator, an automatic sampler, belt elevators, a cyanide plant of 1 ton capacity, a 3 x 8 roasting furnace, an 18-inch amalgamation pan, a sample crusher, and sample grinder.

The mining machinery equipment consists of an Ingersoll-Sergeant drill and air compressor with a complete tool-sharpening kit and set of drills.

The equipment of the laboratory is so arranged as to admit of the following being carried out on a working scale: Dry crushing and automatic sampling of an ore to any mesh coarser than a 40 screen: coarse and fine concentration of an ore after crushing with either stamp battery or rolls; wet crushing; plate amalgamation and concentration of gold ores; cyanide treatment of either gold or silver ores after stamping or from the rolls—the roasting furnace enabling ores to be given a chloridizing or an oxidizing roasting before treatment in the vats—and, finally, pan amalgamation of silver ores. All the machines are so arranged as to admit of independent working or working in conjunction. A 15-horsepower and a 5-horsepower induction motor drive all the machinery through separate line shafts.



ASSAYING LABORATORY



CORNER MINING LABORATORY

THE DEPARTMENT OF GEOLOGY AND MINERALOGY

The Department of Geology and Mineralogy is kept in close touch with the Department of Mining and Metallurgy, and every effort is made to give practical value to the work. While, however, all courses in Geology and Mineralogy are thus treated as bearing directly upon mining as an active industry, at the same time their intrinsic value for scientific training is not lost sight of, and a complete theoretic presentation of the subject is aimed at in all cases.

The department is provided with laboratories for both Geology and Mineralogy, with reference collections illustrating the minerals, rocks and fossils, and class collections for study and determination. The Petrographical laboratory is equipped with apparatus for making thin sections, and with petrographical microscopes and the necessary accessories; it has also a set of mineral thin sections cut in definite directions, and a collection of rock sections with many representatives of each of the chief types, together with many sections illustrating special types. Blowpipe and other chemical work is also provided for.

A lantern with a growing collection of slides, furnishes additional illustrative material for lecture work.

In the new Mackay building the Mineralogical laboratory will be larger and more convenient, being arranged, for the present, for the accommodation of single sections of 32 students. There will be, in addition, a separate laboratory specially fitted up for microscopic work.

One wing of this building will be devoted to a museum, in which the collections of the departments may be suitably housed and exhibited. These collections include, in addition to general material, the nucleus of a collection illustrating the mineral resources of the State of Nevada, with specimens for comparison from other important mining regions.

This State presents excellent opportunities for geological study and investigation, the rocks and varied structural features being everywhere well exposed. Besides sedimentary rocks of various ages, there is a great variety of igneous rocks, ranging from coarse to fine-grained, and from acid to basic types. The physiographic and structural features include the much discussed Basin Range structure, the deposits, terraces and other records of the Quaternary Lake Lahontan, and of other ancient lakes. Although these features are already more or less well known, much yet remains to be investigated in connection with them, while, in addition, there are in the State numerous problems as yet untouched, which involve both the practical and theoretical aspects of geology. To the student of mining, in particular, unusual opportunities are presented, in the mining regions of this State and in the adjacent areas of the Sierra Nevadas, for the investigation of problems connected with ore deposition.

THE SCHOOL OF MECHANICAL ENGINEERING

Technical Schools were brought into active existence by the Morrill Act which became a law in 1862. This Act provided for a college in each state in which Agriculture and Mechanic Arts should be taught. The School of Mechanical Engineering owes its existence primarily to this Act.

All engineering is dependent upon the use of tools and machinery. Recognizing this fact, the University of Nevada offers a thorough course in the Mechanic Arts. The aim of the Department is to prepare its students in the various branches of mechanical and electrical work with which they may hereafter have to do.

The course of study occupies four years, and is divided into two chief periods of two years each. During the first period the time is devoted to Mathematics, Chemistry, Physics, English, Mechanical Drawing and Shop work. In the wood shop, instruction is first given in the fundamental exercises of carpentry and wood turning. Then comes a practical application of the skill attained, in the construction of patterns for castings and the framing of timbers.

In the forge shop, the work includes among other things, the making of welded joints, blacksmith tongs, machine tools, drills, etc.

Then follows the machine shop work to give familiarity with the operations of turning, milling, shaping, filing, pipe fitting and other essential points in the handling and cutting of metals. Such shop-work helps the student to take hold of practical work and to deal with men more intelligently.

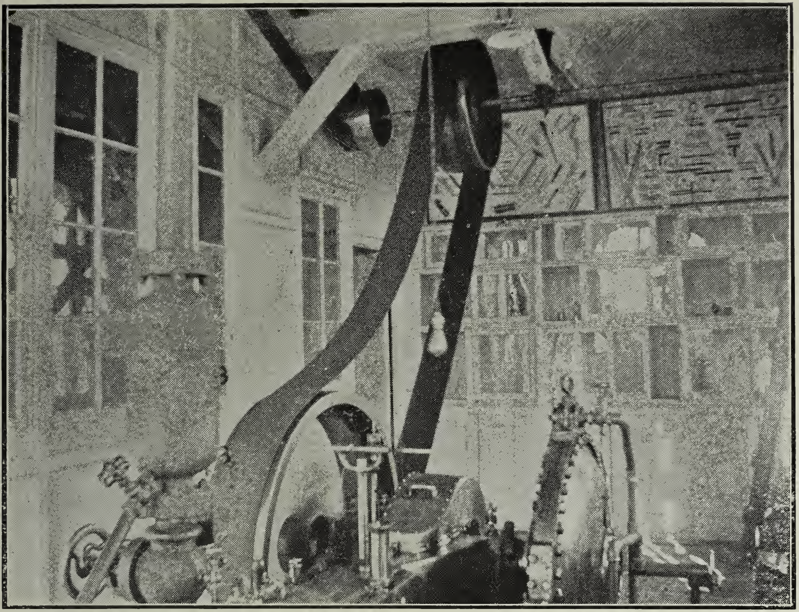
During the Junior year mechanical and electrical engineering are taken up in earnest. The equipment for these branches consists of steam and gas engines, dynomos, motors, engine indicators, voltmeters, ammeters, wattmeters and many other similar pieces of apparatus.

Through the generosity of the Truckee River General Electric Company, the Reno Power, Light and Water Company and others, a number of power plants in the vicinity are open to students of the Department for inspection and tests.

In addition to the laboratory work, courses are given in the design of machine tools, valve gearing and electrical machinery. Special attention is paid to the construction, care and handling of gas and gasoline engines, motors and water wheels.

The mechanical engineer's training is further strengthened by the study of surveying, hydraulics, analytical mechanics and strength of materials.

During the last part of the Senior year the time of each individual is given entirely to the study of some specific phase of mechanical or electrical engineering. The result of this study is embodied in a thesis which must be completed before graduation.



CORNER MECHANICAL LABORATORY

MECHANICAL BUILDING

THE SCHOOL OF CIVIL ENGINEERING

The design of this school is to furnish a course of theoretical instruction, accompanied and illustrated by a large amount of practice, bearing in mind always that the power to acquire information and ability to use it are of far greater value than any amount of so-called practical knowledge.

In most of the courses a text-book of recognized standing is used as the backbone of the instruction, supplemented by lectures, and books of reference, and in all, a maximum number of problems is required.

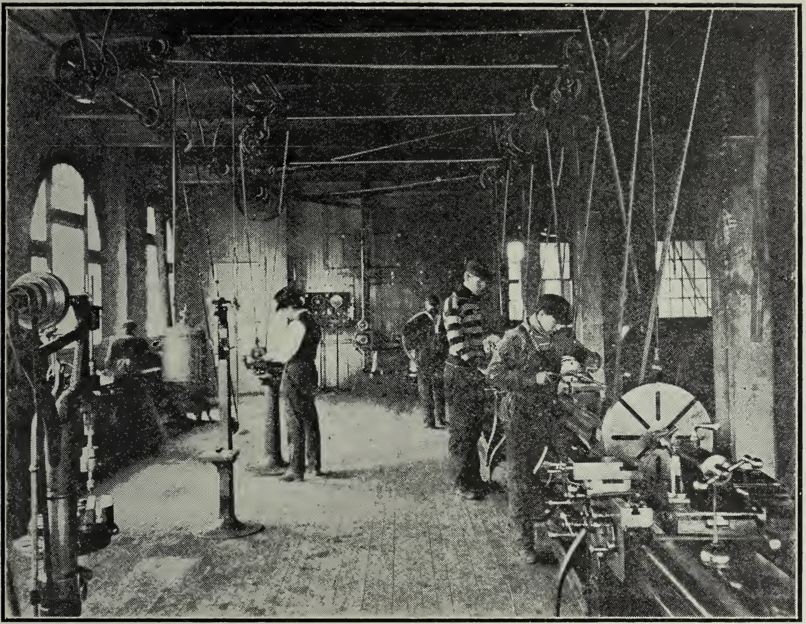
The course in Surveying is particularly thorough and fits the student for any position in Land, Railroad or Mine surveying. In addition to the recitation and drawing room work, the class solves a large number of field problems, each student being required to keep complete and accurate notes of each day's work. For this purpose the class is divided into squads of four men, the different duties being performed by each in turn, thus duplicating as nearly as possible the actual conditions in practice.

Considerable attention is paid to the subject of Mining Law, relative to the Location and Patenting of Claims. Practical experience in underground work is obtained on the mine Surveying trip at the close of the Junior year.

In the Senior year the student is required to execute original designs for various structures and to prepare plans, specifications, estimates of cost, and contracts.

In the preparation of his thesis (required from all candidates for degree of B. S. in C. E.) the student is expected to show his capacity for *independent* investigation, research and design, and the ability to present a logical and concise report.

The equipment of this school consists of a technical library, a collection of catalogs, trade publications, working drawings and photographs of bridges, buildings and other public works; the instrumental equipment for surveying practice, which is as follows: One mining transit, two Solar transits, four complete engineer's transits, two Wye levels, two Dumpy levels, one Railroad compass, one plane table, and a complete assortment of leveling rods, range poles, stadia rods, tapes and chains, and a cement testing laboratory provided with testing machine, molds, sieves, etc.



MACHINE SHOP

WOOD SHOP

DEPARTMENT OF PHYSICS

The Department of Physics offers a two year course in general physics, consisting of experimental lectures and demonstration by the instructor, and recitations and quantitative laboratory exercises by the student, which is one of the important foundation courses in the work outlined for all students in the college of engineering.

On completion of the Mackay building, the entire ground floor of the old mining building will be available for the work of the department and will furnish ample lecture room and laboratory facilities.

An appropriation by the recent Legislature has enabled the department to provide a thoroughly up-to-date equipment, and it now offers to interested students an opportunity for an exceptionally strong course.

DEPARTMENT OF CHEMISTRY

The course in Chemistry is arranged especially to meet the needs of prospective engineers. During the Freshman year all engineering students are required to cover the same ground in chemistry, but with the beginning of the Sophomore year the work is outlined for the individual engineering schools so that the student works on that part of chemistry which is most intimately connected with his chosen profession.

A new and well-equipped building has recently been constructed for the exclusive use of the Department of Chemistry. Separate laboratories have been furnished for General Chemistry, Quantitative Analysis, Electrolytic Chemistry and Gas and Water Analysis.

The recent Legislature has given a liberal appropriation to the department for books and chemical supplies. When these materials are added to the present equipment the facilities will be ample for doing thorough work in chemistry.

There is a constantly increasing demand for men who are not only trained engineers but also skilled chemists to take charge of enterprises involving chemical processes. The department will aim to give advanced work in chemistry to students looking toward Chemical Engineering as a profession.

CONDITIONS OF ADMISSION

1. Entrance to the Engineering Schools shall be by examination, excepting that a graduate of an accredited school will be received without examination in those subjects in which such school is accredited.

2. High schools of other States, if accredited by a State University or other University of first rank, will be recognized in so far as the work done is equivalent to the work required here. The applicant from such a school must supply the evidence that the school is accredited.

ADMISSION REQUIREMENTS TO ENGINEERING SCHOOLS.

I	English	(a)	5
		(b)	5
		(c)	5
II	Mathematics (Algebra and Plane Geometry)	(a)	5
		(b)	5
		(c)	5
III	Physics		5
IV	American History		5
V	General History		5
VI	Chemistry		5
VII	Physical Geography		2½
VIII	Botany		2½ or 5
IX	Zoology		2½ or 5
X	Physiology		5
XI	Latin	(a)	5
		(b)	5
		(c)	5
XII	German	(a)	5
		(b)	5
XIII	French	(a)	5
		(b)	5
XIV	Spanish	(a)	5
		(b)	5
XV	Greek	(a)	5
		(b)	5
		(c)	5
XVI	Bookkeeping		2½
XVII	Shopwork		5
XVIII	Drawing		2½

Candidates for admission most present subjects I, II, III and IV and 20 units of additional credit selected from subjects V to XVIII inclusive. One hour's work per week per semester is credited as one unit.

SPECIAL STUDENTS.

Persons who are not candidates for a degree, and who wish to pursue some one study and its relative branches, may be admitted as special students without passing the usual entrance examination on the recommendation of the professor under whom the special studies are to be taken; but the professor concerned may impose any test by examination or otherwise that he may deem advisable. Special students must, however, be at least twenty years of age. For adequate reasons exceptions to the above rule may be made by the faculty.

NOTE.—The University also maintains an excellent preparatory department.

COLLEGE OF ENGINEERING

COURSE OF STUDY

FRESHMAN YEAR—ALL SCHOOLS.

Subject	1st Semester	Subject	2nd Semester
Mathematics 3, 4	5	Mathematics 5 and 7	5
English 1	3	English 1	3
Drawing 1	2	Drawing 2	2
Mechanical Arts 1	2 Lab.	Mechanical Arts 1	2 Lab.
		Mechanical Arts 2	2 Lab.
Chemistry 1	2	Chemistry 1	2
Chemistry 2	2 Lab.	Chemistry 3	2 Lab.
Physics 1	1 and 1 Lab.	Physics 1	1 and 1 Lab.
Drill	1	Drill	1

SCHOOL OF MINES

SOPHOMORE.

Subject	1st Semester	Subject	2nd Semester
Mathematics 8	3	Mathematics 9	3
Chemistry 5	3 Lab.	Chemistry 6	3 Lab.
Physics 2	3	Physics 2	3
Physics 3	2 Lab.	Physics 3	2 Lab.
Mineralogy 1	2 Lab.	Mineralogy 1	2 Lab.
Drawing 3	3	Drawing 4	3
M. E. 1	3	M. E. 1	3
Drill	1	Drill	1

JUNIOR.

Mining 7	2	Mining 12	3
Mining 11	2	Mineralogy 3	2
Mineralogy 2	2	Geology 2	2
Geology 1	3	Mathematics 10	3
Mathematics 10 and 11	5	Mineralogy 5 and 6	3
C. E. 9	2	C. E. 1	2 and 2 Lab.
C. E. 1	2 and 2 Lab.	Geology 5	Field work 1 Lab.
Mining 4	2 Lab.	C. E. 12	Field work
Drill	1	Drill	1
Mining 7	2		

SENIOR.

Mining 1	4	Mining 2	4
Mining 3	1	Mining 3	1
Mining 8	4	Mining 5	Field Work
Geology 5	1 Lab.	Mining 6	1
		Mining 9	4
Mining 10	2	Mining 10	2
Geology 3 and 4	3	Geology 6	3
C. E. 8	3	Thesis	2
Drill	1	Drill	1

SCHOOL OF MECHANICAL ENGINEERING

SOPHOMORE.

Subject	1st Semester	Subject	2nd Semester
Mathematics 8	3	Mathematics 9	3
Drawing 3	3	Drawing 3	1
		Drawing 4	3
Physics 2	3	Physics 2	3
Physics 3	2 Lab.	Physics 3	2 Lab.
Mechanical Arts 3	2 Lab.	Mechanical Arts 3	2 Lab.
M. E. 1	3	M. E. 1	3
Chemistry 5	3 Lab.		
Drill	1	Drill	1

JUNIOR.

Mathematics 10 and 11	5	Mathematics 10	3
C. E. 9	2	M. E. 3	2
Mining 7	2	Mining 7	2
El. E. 1	3	El. E. 2	3
M. E. 2	2	M. E. 4	2
Drawing 5	2 Lab.	Drawing 6	3 Lab.
C. E. 1	2 and 2 Lab.	C. E. 1	2 and 2 Lab.
Drill	1	Drill	1

SENIOR.

El. E. 3	3	El. E. 3	3
M. E. 5	4	M. E. 6	4
C. E. 5	4	Drawing 8 and 9	4
Drawing 7	3	Drawing 7	3
C. E. 8	3	M. E. 8	3
M. E. 10	2	Thesis	2
Drill	1	Drill	1

SCHOOL OF CIVIL ENGINEERING

SOPHOMORE.

Subject	1st Semester	Subject	2nd Semester
Mathematics 8	3	Mathematics 9	3
Drawing 3	3	Drawing 3	1
Chemistry 5	3 Lab.	Drawing 4	3
Physics 2	3	Physics 2	3
Physics 3	2 Lab.	Physics 3	2 Lab.
Mineralogy 1	2 Lab.	Mineralogy 1	2 Lab.
M. E. 1	3	M. E. 1	3
Drill	1	Drill	1

JUNIOR.

Mathematics 10 and 11	5	Mathematics 10	3
C. E. 1	2 and 2 Lab.	C. E. 1	2 and 2 Lab.
C. E. 9	2	C. E. 2	2
Geology 1	3	Geology 2	2
Mineralogy 2	2	C. E. 6	3
Mining 7	2	Mining 7	2
		M. E. 3	2
		Geology 5	Field work
		C. E. 12	Field work
Drill	1	Drill	1

SENIOR.

Mining 1	4	C. E. 11	2
C. E. 3	5	Mining 6	1
C. E. 5	5	C. E. 4	5
C. E. 8	3	C. E. 7	3
		C. E. 10	2
		Elective	3
		Thesis	2
Drill	1	Drill	1

COURSES OF INSTRUCTION

VI English
IV Geology
XXV Mineralogy
XXVI Chemistry
XXVII Physics
XXVIII Mathematics
XXIX Mining
XXX Mech. Eng.
XXXI Elec. Eng.
XXXII Mech. Arts
XXXIII Civil Eng.
XXXIV Drawing
XXXV Military

VI. ENGLISH.

English 1. Composition, Rhetoric, and Public Speaking. Themes in narration, description, exposition, and argumentation. Practice in oral reading, declamation, oration, and debate. Carpenter and Brewster: Modern English Prose. Hill: Foundations of Rhetoric. Shurter: Public Speaking. Freshmen, all schools. Both semesters. Professor Seward. (......3.)

For description of other courses, see English, College of Arts and Science.

XXIV GEOLOGY

Geology 1. Dynamic and Structural Geology. A general discussion of geological forces and their results. Lectures and recitations. Juniors, C. E. and Mines. First semester. Professor Smith. (......3.)

Geology 2. Historical Geology. An outline of the history of the earth, including diastrophic changes, stratigraphic relationships and descriptions of the physical geography and life of the successive geological periods, with special reference to the North American continent. Lectures and Recitations. Prerequisite: Geology 1. Juniors, C. E. and Mines. Second semester. Professor Smith. (......2.)

Geology 3. Elementary Petrology. Lectures on the classification, characters and origin of rocks. Text: Harker, Petrology for Students. Prerequisites: Geology 1 and Mineralogy 4. Seniors, Mines. First semester. Professor Smith. (......2.)

Geology 4. Petrographic Laboratory. The study of rocks in the hand specimen and in thin section with the miscroscope. Text: Harker. Prerequisite: Mineralogy 5 and Geology 3 (the latter may be taken concurrently). Seniors, Mines. First semester. Professor Smith. (Lab. 1.)

Geology 5. Field Geology. Instruction in field methods with actual practice in the investigation of selected areas in the vicinity of the University. The work includes the preparation of a report, with geological map and cross-sections of a specified area. Occasional trips will be taken to more distant points. Ten days of field work, commencing the second semester of the Junior year and ending the first semester of the Senior year. Juniors and Seniors, Mines. Saturdays as announced. Professor Smith. (Lab. 2.)

Geology 6. Economic Geology. A study of the mode of occurrence, origin and distribution of the principle ores, non-metallic minerals and rocks used in the arts and industries, with descriptions of typical examples from important mining regions. Lectures and recitations. Text: Ries, Economic Geology of the United States. Prerequisites: Mineralogy 3, Geology 2 and 3. Seniors, Mines. Second semester. Professor Smith. (......3.)

Geology 20. Undergraduate Thesis Course. At least two periods a week for one semester. Professor Smith.

Geology 21. Graduate Course. Original investigation of geological problems, with seminary for discussion of current geological literature and special topics. Professor Smith.

XXV MINERALOGY

Mineralogy 1. Mineralogical Laboratory. (a) The determination of the more common minerals chiefly by means of their physical properties, using such simple physical tests as are of easy application in the field. (b) The determination of minerals by blowpipe analysis. Texts: (a) Eakle's or Crosby's Mineral Tables; (b) Brush-Penfield, Determinative Mineralogy and Blowpipe Analysis. Prerequisites: Chemistry 1, 2 and 3. Sophomores, C. E. and Mines. Both semesters. Professor Smith. (Lab. 2.)

Mineralogy 2. Crystallography. Lectures, recitations and laboratory practice on the morphology of minerals. Text: Williams, Element of Crystallography. Juniors, C. E. and Mines. First semester. Professor Smith. (......1.) (Lab. 1.)

Mineralogy 3. Descriptive Mineralogy. Lectures on the classification, salient properties and mode of occurrence of the more important minerals, illustrated by typical specimens. Text: Dana, Text Book of Mineralogy. Prerequisites: Mineralogy 2 and first semester of Mineralogy 1. Juniors, Mines. Second semester. Professor Smith. (......2.)

Mineralogy 4. Optical Properties of Minerals. Lectures. Based on Idding's Rock Minerals. Prerequisites: Physics 2, Mineralogy 2. Juniors, Mines. Second semester. Professor Smith. (......2.)

Mineralogy 5. Laboratory course in the Optical Properties of Minerals. Microscopic study and determination of the rock-making minerals in thin section, including the preparation of material for microscopic work. Text: Luqner, Minerals in Rock Sections. Reference: Iddings, Rosenbusch-Iddings, Hussak-Smith, Rutley, etc. Second semester. Pro- (May be taken concurrently.) Juniors, Mines. Second semester. Professor Smith. (Lab. 1.)

Mineralogy 6. Graduate course. Opportunity is offered to students suitably prepared, for advanced work and research in Mineralogy and Crystallography. Professor Smith.

XXVI CHEMISTRY

Chemistry 1. General Inorganic Chemistry. Lectures and recitations on the elementary theories and principles of chemistry. Given in connection with course two. Freshmen. Both semesters. Professor Adams. (......2.)

Chemistry 2. A laboratory course illustrating and verifying the fundamental laws of Chemistry. Freshmen. First semester. Professor Adams. (Lab. 2.)

Chemistry 3. A laboratory course in Qualitative Analysis. Prerequisites: First half of Chemistry 1 and all of Chemistry 2. Freshmen. Second semester. Professor Adams. (Lab. 2.)

Chemistry 5. Quantitative Analysis. Training in the general methods of manipulation will be given in both bravimetric and volumetric Analysis. Prerequisites: Chemistry 3. Sophomores, M. E., C. E. and Mines. First semester. Professor Adams. (Lab. 3.)

Chemistry 6. Advanced Quantitative Analysis. Special attention will be given to the analysis of the ores of the common metals. Prerequisite: Chemistry 5. Sophomores, Mines. Second semester. Professor Adams. (Lab. 3.)

XXVII PHYSICS

Physics 1. General Physics. Mechanics, properties of matter and heat. One experimental lecture and recitation, and one laboratory period per week throughout the year. Freshmen. Both semesters. Professor Minor. (1 and Lab. 1.)

Physics 2. General Physics. Lectures and recitations with experimental illustrations and problems. Sound, light, magnetism, and electricity, given as a continuation of course 1. Sophomores. Both semesters. Professor Minor. (......3.)

Physics 3. Physical Measurements. Experimental work in sound, light, magnetism, and electricity of distinctly quantitative character. Methods selected involving fundamental physical principles and illustrating their most important practical applications. The work is presented so as to enable each student to build up for himself a working knowledge of the subjcet. Sophomores. Both semesters. Professor Minor. (Lab. 3.)

Physics 20. Special undergraduate courses. Undergraduate thesis work and all special laboratory work not included in the courses announced above. Professor Minor.

XXVIII MATHEMATICS

Mathematics 3. Algebra. The subjects covered are those usually given after simultaneous quadratic equations in such texts as Fisher and Schwatt, Well, Bowser or Wentworth. Special emphasis is placed upon the following subjects: Ratio, proportion, variation, progressions, undetermined coefficients, the binomial theorem, logarithms, series, and the theory of equations. Freshmen. First semester. Professor Thurtell. (......3.)

Mathematics 4. Solid Geometry. The geometry of the plane, the cylinder, the cone, the prism, the pyramid, and the sphere. Freshmen. First semester. Professor Thurtell. (......2.)

Mathematics 5. Plane Trigonometry. This course covers the subject as presented in such texts as Wells, Wentworth, Murray, or Crockett. Prominence is given to the relation of functions, transformation of trigonometric expressions, and the derivation of formulas. Freshmen. Second semester. Professor Thurtell. (......2.)

Mathematics 6. Spherical Trigonometry. The solution of all cases of spherical triangles, and the application of spherical trigonometry to elementary problems of practical astronomy. Elective. Professor Thurtell. (......2.)

Mathematics 7. Analytic Geometry. A study of the straight line, transformation of co-ordinates, the conic sections, the general equation of the second degree, a few higher plane curves, and an introduction to analytic geometry of three dimensions. Freshmen. Second semester. Professor Thurtell. (......3.)

Mathematics 8. Differential Calculus. A thorough study of the fundamental principles of the differential calculus, followed by their application to expansion in series, tangents and normals, contact and curvature, indeterminate forms, maxima and minima. Sophomores. First semester. Professor Thurtell. (......3.)

Mathematics 9. Integral Calculus. Summation, rectification of curves, areas of plane curves, areas of surfaces of revolution, volumes of solids of revolution, volumes of other solids, moments of inertia. Sophomores. Second semester. Professor Thurtell. (......3.)

Mathematics 10. Analytic Mechanics. The development of the essential principles of mechanics, followed by exercise in solving practical problems. Juniors. Both semesters. Professor Thurtell. (......3.)

Mathematics 11. Mechanics of Materials. Application of the principles of statics to rigid bodies; elasticy and resistance of materials; discussion of beams and columns; forms of uniform strength; riveting; torsion of shafts; combined, apparent, and true stresses, and computation of the proper size and proportions for beams, columns, etc. Juniors. First semester. Professor Thurtell. (......2.)

XXIX MINING AND METALLURGY

Mining 1. Lectures and recitations. Excavation, explosives, tunneling, boring, shaft-sinking. Seniors, Mines and C. E. First semester. Professor Young. (......4.)

Mining 2. Lectures and recitations. Ore deposits, prospecting, development, exploitation, examination, management, mine equipment, mining law. Seniors, Mines. Second semester. Professor Young. (......4.)

Mining 3. Mining Laboratory. Problems in engineering and in the design of mining and metallurgical machinery; review and discussion of technical journals and books. Seniors, Mines. Both semesters, Lab. Professor Young. (Lab. 1.)

Mining 4. Mining Laboratory. The work in this course consists of practice in sharpening and tempering hand and machine drills, in the use of the same, and in forging and welding. Juniors, Mines. First semester. Professor Young. (Lab. 2.)

Mining 5. Excursions. During the year two extended trips are taken to Virginia City and vincinity. The first trip is taken during the latter part of the first term and has for its object the study of an ore deposit. The surface and underground conditions and the relationship of the mine openings and underground work to the deposit are the special subjects of study. Mapping of the geological formations is also done in order to facilitate interpretation of the structure. The second trip, taken in the latter half of the second semester, has for its object the study of the mine surface plants, mine equipment, underground work, mills, cyanide and reduction plants. A report of the observations, together with sketches is required of each student. Seniors, Mines. Professor Young.

Mining 6. Engineering Contracts and Specifications. Lectures and text. Seniors, Mines and C. E. Second semester. Professor Young. Reference, Johnson's Engineering Contracts and Specifications.

Mining 7. Metallurgy (General). Lectures and recitations. Physical properties of the more important metals and alloys; manufacture and physical properties of the structural metals; fuel and heat measurement; metallurgical furnaces, processes and products; crushing and sampling of ores. Juniors, Mines, C. E. and M. E. Both semesters. Professor Young. Reference, Introduction to study of metallurgy (Roberts-Austin.)

Mining 8. Metallurgy (Gold and Silver). Lectures and recitations. A discussion of the ores, processes of separation, plants and machinery, management and economic conditions. Seniors, Mines. First semester. Professor Young. Reference, Rose's Metallurgy of Gold; Collin's Metallurgy of Silver; Cyanide Practice (Julian and Smart). (......4).

Mining 9. Metallurgy (Copper, Lead, Zinc). Lectures and recitations. A discussion of the ores, methods of reduction, plants and machinery, management and economic conditions. Seniors, Mines. Second semester. Professor Young. Reference, Peters' Principles of Copper Smelting; Hofman's Metallurgy of Lead; Ingall's Metallurgy of Zinc. (......4.)

Mining 10. Metallurgical Laboratory. A series of experiments are given which are designed to supplement, in part, the class-room work and to illustrate the more important methods of ore treatment. Complete ore tests on a working scale are used to supplement the small scale experiments. Seniors, Mines. Both semesters. Professor Young. (Lab. 2.)

Mining 11. Assaying. Lectures and recitations. Methods of assay, systems of weights used, calculations and problems, equipment of assaying laboratories, sampling, chemistry of assaying, errors and losses in assaying, special topics. Juniors, Mines. Both semesters. Professor Young. Lodge's Notes on Assaying. (......1.)

Mining 12. Assaying Laboratory. Practice in weighing, crushing and sampling of ores; scorification and crucible assay; assay of metallurgical products; use of miner's pan, horn, and batea. Juniors, Mines. First semester. Lab. 1. Second semester, Lab. 2. Professor Young.

Mining 20. Thesis. Each Senior student is required to hand in a thesis on some subject in mining or metallurgy or related branch of engineering. Seniors, Mines. Second semester. Professor Young.

XXX MECHANICAL ENGINEERING

Mechanical Engineering 1. Power and Power Transmission. A study of the operation and construction of steam, gas and oil engines, turbines, water wheels, motors, etc., and the methods of power transmission. The subject is treated in a practical manner. Sophomores, M. E., C. E. and Mines. Both semesters. Professor Scrugham. (......3.)

Mechanical Engineering 2. Kinematics. The geometry of machinery, showing the laws which govern the velocity of moving parts, velocity ratio in various motions, the correct forms for gear teeth, quick return motions, link motions and the manner of designing trains of mechanism. The mathematical demonstrations and proofs are first studied from text book, and then practical problems are given to the student to solve on the drawing board. Juniors, M. E. First semester. Mr. Freeman. (......2.)

Mechanical Engineering 3. Machine Design. A study of the application of the laws of velocity, force, and strength of materials to the design of machinery. The design of tooth and belt gearing, shafts, journals, hangers, cylinders, springs, bolts, keys, etc. The text-book work is strengthened by the practical work on the drawing board. Juniors, M. E. and C. E. Second semester. Professor Scrugham. (......2.)

Mechanical Engineering 4. Theory of Steam Boilers. The design and construction of the various types of commercial steam boilers; including methods of riveting and staying; the care of boilers, the prevention of scale and corrosion, consumption of fuel, determining the horsepower of boilers, the design of boilers for efficiency and economy; the methods of power transmission and the study of modern boiler plants. At the completion of the text book each student is required to design a boiler, or a battery of boilers and necessary fittings. This includes the preparation of specifications and complete working drawings, ready for the boiler maker and the erecting engineer. Juniors, M. E. Second semester. Professor Scrugham. (......2.)

Mechanical Engineering 5. Steam Engine. The principles involved in the design and construction of the steam engine, including theoretical indicator and crank-effort diagrams for various types of engines. This work is supplemented by experimental work in the laboratory. Seniors, M. E. First semester. Mr. Freeman. (......4.)

Mechanical Engineering 6. Gas Engines and Gas Producers. The principles involved in the design and construction of gas and oil engines and gas producers. The composition of the hydrocarbon gases and oils is discussed and comparative costs and efficiencies considered. Seniors, M. E. Second semester. Professor Scrugham. (......4.)

Mechanical Engineering 7. Power plants. The mechanical engineering of power plants is here presented in rather a non-mathematical way and the machinery appliances and economical auxiliaries employed have their practical and experimental side shown. Senior. Second semester. Professor Scrugham. (......3.)

Mechanical Engineering 8. Valve Gearing. A study of the various forms of standard engine valves, link motions, radical gears and shaft regulation. The mathematical proofs of the methods and results attained by the Zeuner, Bilgram, Reauleaux and Elliptical diagrams are studied from the text book, after which the designing of the valve gears becomes a drawing-board process. Each student before completing the work must design some form of standard engine valve, and governor; the data being taken from trade catalogues and engines actually in use. Senior. Second semester. Mr. Freeman. (......3.)

Mechanical Engineering 9. A special course embracing mensuration, elementary mechanics, pneumatics and steam engineering is offered for mechanics and artisans engaged at their trade during the day. This course is designed more especially for railroad employees, but is open to all desiring to become more proficient in the above mentioned subjects. Two evenings per week. Professor Scrugham.

Mechanical Engineering 10. Engineering Laboratory Practice. This course covers the various methods of conducting and working up tests, determining efficiencies, driving powers, etc., and is supplemented by practical tests on a number of pieces of apparatus. Seniors, M. E. First semester. Professor Scrugham. (......2.)

Mechanical Engineering 20. Thesis Work. The latter part of the second semester of the Senior year is given to thesis work. This consists of some new design of a machine or an original investigation of some subject congenial to the student's taste and included in the scope of the course. The subjects for these theses are assigned to the student by the head of the Mechanical Engineering Department, and the completed theses, together with the drawings and illustrations accompanying them, are kept on file that they may serve as references for future investigations. Seniors. Second semester. Hours to be arranged. Professor Scrugham. (......2.)

XXXI ELECTRICAL ENGINEERING

Electrical Engineering 1. Electricity and Magnetism. Frictional Electricity, Magnetism, Current Electricity, Electrostatics, Electro-magnetics, Measurement of Currents, Thermo-electricity, Heat, Power and Light from Electric Currents, Inductance, Dynamos, Motors, Transformers, Electro-Chemistry, Telegraphy, Telephony, and Electric Waves. Prerequisite: Physics 2. Juniors. First semester. Professor Scrugham. (......3.)

Electrical Engineering 2. Electric Power Transmission. Electric lighting and power distribution. Relative costs and efficiencies of various types of prime movers. Tests, specifications, etc. Prerequisite: E. 1. Juniors, M. E. Second semester. Professor Scrugham. (......3.)

Electrical Engineering 3. Alternating Currents. Theory and application of single-phase and polyphase currents, alternating current dynamos and motors, transformers, controlling apparatus, etc., supplemented by tests on Electrical Machinery. Prerequisite: E. E. 2. Seniors, M. E. Both semesters. Professor Scrugham. (......3.)

XXXII MECHANIC ARTS

Mechanic Arts 1. Wood Shop. The work in this branch of the department is required of students in Mechanical Engineering, Civil Engineering, and Mining Engineering, and may be taken by any other male student desiring it, provided accommodations are at hand. At present there are thirty students. This work is carried through both semesters of the Freshman year, and the instruction is intended to familiarize the student with the use of hand and machine tools and with the most approved methods and processes followed in engineering construction. The text book used in connection with the practical work is: Goss, Bench Work in Wood. The bench work includes the following operations: Plowing, sawing, rabbeting, planing, notching, splicing, mortising, tenoning, dovetailing, framing, paneling, and the general use of carpenters' tools. The wood turning involves the various principles of lathe work in wood, and is carried on from a set of blue prints issued by the department for that purpose. Pattern-making, which gives the student discipline in the construction of patterns for foundry work, is taken only by students in Mechanical Engineering. Freshmen. Both semesters. Mr. Freeman and Mr. Powers. (Lab. 2.)

Mechanic Arts 2. Forge Shop. The forge shop contains twelve forges, equipped with smithing tools, and is fitted with pressure and exhaust system piping and fans. The work in forging includes exercises in heating, bending, drawing, upsetting, plain welding, butt welding, lap welding, ring welding, tee welding, etc. In steel forging the exercises include the making and tempering of punches, drills, chisels, annealing, case-hardening and the making of a complete set of machine-cutting tools for the student's future use in the machine shop. Freshmen. Second semester. Mr. Freeman and Mr. Powers. (Lab. 2.)

Mechanic Arts 3. Machine Shop. Instruction in the work consists of vise work in iron, including surface chipping, squaring and fitting, round filing, sawing, scraping, and polishing. Machine work in metals includes exercises in straight and taper turning, slotting, drilling, boring, planing, and screw cutting. Practice in the machine shops begins with a series of simple exercises teaching the proper use of the hammer, chisel, and file; the laying out of work, and the use of the lathe, shaper, milling machine, etc. As the student becomes familiar with the use of tools and machines, he is given work on simple machine details and construction, and finally assembles the parts into the complete machine. Sophomores, M. E. Both semesters. Mr. Freeman and Mr. Powers. (Lab. 2.)

XXXIII CIVIL ENGINEERING

Civil Engineering 1. Surveying. Instruction is given by means of lectures, recitations, field and office work in the theory, use and adjustment of the compass, level, and transit. The field work covers the determination of distances, angles, and areas by the several methods; differential, profile, and contour leveling, and miscellaneous surveys such as are met with in actual practice. Topographic Surveying: Theory and use of plane-table and stadia; methods of topographic surveying; topographic sketching and drawing. A complete topographic survey based on a system of triangulation is executed, and maps constructed from same. Railroad Curves: Theory and practice of railroad curves as applied to railroad surveys. Juniors. Both semesters. Professor Baker. "Surveying," Johnson and "Surveying Manual," Pence and Ketchum. (Lab. 2.) (......2.)

Civil Engineering 2. Roads and Pavements. Value and importance of improvement in country highways and city streets; methods of construction and maintenance; elements of cost; comparative adaptability. "Roads and Pavements," Baker. Juniors, C. E. Second semester. Professor Baker. (......2.)

Civil Engineering 3. Structural Analysis. Computation of stresses in various framed structures by algebraic and graphical methods. Structural Details: The student makes a tracing of a shop drawing of a bridge or roof-truss, computes the weight and cost, and makes a critical report on the design. Seniors, C. E. First semester. Professor Baker. (......5.)

Civil Engineering 4. Structural Design. Design of modern framed structures, making complete detail drawings for same. Seniors, C. E. Second semester. Professor Baker. (......5.)

Civil Engineering 5. Railroad Engineering. Lectures, recitations, field and office work in methods and operations necessary to survey and construct a new railroad and to reconstruct the old line. To secure familiarity with methods of actual practice, the class makes a complete survey, maps, profile, and calculations for a short line of new railroad. Switches, frogs, turnouts, yard layouts, railway appliances and maintenance. Laboratory work two whole afternoons, counting as three periods. "Railroad Engineer's Manual," Nagle. Seniors, C. E. and M. E. First semester. Professor Baker. (Lab. 3.) (......2.)

Civil Engineering 6. Sewers. Sewerage and surface drainage of cities and towns. Separate and combined systems, modern methods of sewage disposal, estimates and specifications. "Sewerage," Folwell. Juniors, C. E. Second semester. Professor Baker. (......3.)

Civil Engineering 7. Masonry Construction. A study of the nature and properties of materials entering into the building of masonry structures but more particularly a course on the design and method of construction of such structures. Each student makes an original design for a masonry dam, an arch, and other minor structures of Irrigation and

Railroad Engineering. "Masonry Construction," Baker. Senior, C. E. Second semester. Professor Baker. (......3.)

Civil Engineering 8. Hydraulics. A study of the elementary principles of hydraulics, the flow of water through orifices, weirs, pipes, conduits, and canals. "Hydraulics," Meniman. Seniors. First semester. Professor Baker. (......3.)

Civil Engineering 9. Graphic Statics. A study of the principles of graphic statics and their application in finding the stresses in framed structures. Juniors. First semester. Professor Baker. (Lab. 1.) (......2.)

Civil Engineering 10. Railroad Structures. A study of current practice in modern railroad structures by means of existing structures, standard drawings, and books of reference. Seniors, C. E. Second semester. Professor Baker. (......2.)

Civil Engineering 11. Irrigation Engineering. A thorough study of the questions involved in the collection, storage, and distribution of water for irrigation purposes. "Irrigation Engineering," Wilson. Seniors, C. E. Second semester. Professor Baker. (......2.)

Civil Engineering 12. Mine Surveying. At the close of the college year the Junior class in surveying takes a two weeks' field trip to Virginia City. Here one of the mines is surveyed and mine maps constructed. All of the ordinary surveying operations that the mining engineer may be called upon to perform are practiced. Juniors, Mines and C. E. Professor Baker.

XXXIV DRAWING

Drawing 1. Freehand Drawing. Drawing of machines, conventional signs, lettering, etc. Freshmen, M. E., C. E., Mines. First semester, five hours. Miss Lewers. (......2.)

Drawing 2. Mechanical Drawing. Plates, lettering, machine parts, etc. M. E., C. E., Mines. Prerequisite: Drawing 1. Freshmen. Second semester, five hours. Mr. Freeman. (......2.)

Drawing 3. Elementary Machine Design. Drawing and design of machine parts, modern shop arrangement, etc. Sophomores, M. E., C. E. Prerequisite: Drawing 2, First semester, five hours. Mr. Freeman. (......3.)

Drawing 4. Descriptive Geometry. Faunce: Descriptive Geometry. Sophomores, M. E., C. E., Mines. Prerequisite: Drawing 2. Second semester, five hours. Mr. Freeman. (......3.)

Drawing 5. Kinematics and Mechanism. Juniors, M. E. First semester. Mr. Freeman. (Lab. 2.)

Drawing 6. Steam Boiler Design. Juniors, M. E. Second semester. Professor Scrugham. (Lab. 3.)

Drawing 7. Advanced Machine Design. Seniors, M. E. Both semesters. Professor Scrugham. (Lab. 3.)

Drawing 8. Valve and Governor Design. Seniors, M. E. Second semester. Mr. Freeman. (Lab. 4.)

Drawing 9. Dynamo Design. Design of dynamos, motors, etc., including all details. Prerequisites: Drawing 7 and Mech. Eng. 12 Seniors, M. E. Second semester. Professor Scrugham. (Lab. 4.)

XXXV MILITARY SCIENCE AND TACTICS

Military 1. The practical instruction embraces squad, company, and battalion drills, both in close and in extended order; bayonet exercises, ceremonies, small-arms target practice, first aid to the injured, guard duty, minor tactics, military signaling and band practice. The theoretical instruction includes those parts of Infantry Drill Regulations, Field Service Regulations, Manual of Guard Duty, and Firing Regulations for Small Arms, which are covered by the practical instruction. Prescribed to all male students. Both semesters. Captain Brambilla.

Military 2. Lectures on Army Regulations, recruiting, the employment of troops, in the enforcement of laws, supply departments, the administration of a company including the preparation of papers and returns, field fortifications, military hygiene, military law, the laws of war on land, the art of war, campaigns and battles, and the General Staff of the Army. Prescribed. Juniors and Seniors. Both semesters. Captain Brambilla.

FEES

For graduation—cost of diploma	$5.00
For material used in Chemical Laboratory, General, Qual., Quant., or Agricultural, per term	2.50
For material used in Mineralogy, per term	2.50
For material used in Assaying, 1st term, $5.00; 2nd term	7.50
For material used in Senior Metallurgy, per term	10.00
For material used in Shop Work, per term	2.00
For material used in Physics (Freshman), per term	1.00
For material used in Physics (Sophomore), per term	2.00

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The following fees are required for breakage or damage, but will be returned at the end of the semester, less the amount of breakage or damage.

Surveying	$5.00
Physics	5.00
Chemistry	5.00
Mineralogy	5.00

A fee of $4.00 per term is levied upon every student by the Associated Student Body. This fee is for the purpose of carrying on athletic sports, such as football, basketball, baseball and track athletics, and also includes debating. The University Regents and the University Faculty are not responsible for this tax upon the students. In return for the payment of this term fee, the students get free admission to all games and events which take place during the year.

EXPENSES

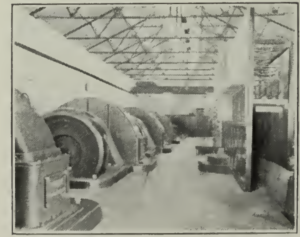
Expenses of living—board, room, light and fuel, per month, $16.00.

Books can be purchased at the University Bookstore at a slight reduction upon the list price.

We give work as far as possible to students who must help to support themselves. This work, however, is limited in amount.

Young men are required to furnish their military uniform.

For catalog and further information address: The President, University of Nevada, Reno, Nevada.



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